



CATEGORY:

MECHANICAL

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ADDRESS  
CONTACT IF FOUND:

66/09/99  
JC580 U.S. PTO

**NEW UTILITY PATENT APPLICATION  
TRANSMITTAL**

DOCKET NO.  
JHP-10-5377

TOTAL PAGES IN THIS SUBMISSION

3

JC135 U.S. PTO  
09/30/99  
66/09/99

**TO THE ASSISTANT COMMISSIONER FOR PATENTS**

**Box Patent Application  
Washington, D.C. 20231**

Transmitted herewith for filing under 35 USC 111(a) and 37 CFR 1.53(b) is a new utility patent application for an invention entitled:

**METHOD AND APPARATUS FOR ROCKET MOTOR DISPOSAL**

and invented by

JOHN HUMPHRIES PARKES

If a **CONTINUATION APPLICATION**, check appropriate box and supply the requisite information:

☐ Continuation

☐ Divisional

☐ Continuation -in -part (CIP)

in prior application No.: \_\_\_\_\_

Enclosed are:

**Application Elements**

1. ☒ Filing fee as calculated and transmitted as described below
2. ☒ Specification having 11 pages and including the following:
  - a. ☒ Descriptive Title of the Invention
  - b. ☐ Cross References to Related Applications (*if applicable*)
  - c. ☐ Statement Regarding Federally-sponsored Research/Development (*if applicable*)
  - d. ☐ Reference to Microfiche Appendix (*if applicable*)
  - e. ☒ Background of the Invention
  - f. ☒ Brief Summary of the Invention
  - g. ☒ Brief Description of the Drawings (*if drawings filed*)
  - h. ☒ Detailed Description
  - i. ☒ Claim(s) as Classified Below
  - j. ☒ Abstract of the Disclosure
3. ☒ Drawing(s) (*when necessary as prescribed by 35 USC 113*)
  - a. ☐ Formal
  - b. ☐ InformalNumber of Sheets 3
4. ☒ Oath or Declaration
  - a. ☐ Newly executed (*original or copy*) ☒ Unexecuted
  - b. ☐ Copy from a prior application (37 CFR 1.63(d)) (*for continuation/divisional application only*)
  - c. ☒ With Power of Attorney ☐ Without Power of Attorney

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Application Elements (Continued)

5. ☐ Incorporation by Reference (*usable if Box 4b is checked*)  
The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.
6. ☐ Computer Program in Microfiche (*Appendix*)
7. ☐ Nucleotide and/or Amino Acid Sequence Submission (*if applicable, all must be included*)
- a. ☐ Paper Copy
- b. ☐ Computer Readable Copy (*identical to computer copy*)
- c. ☐ Statement Verifying Identical Paper and Computer Readable Copy

Accompanying Application Parts

8. ☐ Assignment Papers (*cover sheet & document(s)*)
9. ☐ 37 CFR 3.73(B) Statement (*when there is an assignee*)
10. ☐ English Translation Document (*if applicable*)
11. ☐ Information Disclosure Statement/PTO-1449 ☐ Copies of IDS Citations
12. ☒ Certified Copies of British Applications GB 9914598.9 and GB 9820720.2
13. ☒ Return Receipt Postcard
14. ☒ Certificate of Mailing  
☐ First Class ☒ Express Mail (*Specify Label No.*): EL 428565017US
15. ☒ Small Entity Statement (*unexecuted*)  
☐ Statement filed in prior application; Status still proper and desired.
16. ☐ Additional Enclosures (*please identify below*):

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**NEW UTILITY PATENT APPLICATION  
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**FEE CALCULATION AND TRANSMITTAL**

**CLAIMS AS FILED**

1) For	2) Number Filed	3) Number Extra	Rate	Additional Fee
TOTAL CLAIMS (37 CFR 1.16(c))	20- 20 =	- 0 -	X\$9.00	\$0.00
INDEPENDENT CLAIMS (37 CFR 1.16(c))	2 - 3 =	- 0 -	X \$39.00	\$0.00
First Pres. of Multiple Dep. Claims	= 0			
Basic Fee	= 0			\$380.00
			TOTAL	\$380.00

- ☐ A check in the amount of \_\_\_\_\_ to cover the filing fee is enclosed.
- ☐ The Commissioner is hereby authorized to charge and credit Deposit Account No. \_\_\_\_\_ as described below. A duplicate copy of this sheet is enclosed.
- ☐ Charge the amount of \_\_\_\_\_ as filing fee.
- ☐ Credit any overpayment or any deficiency.
- ☐ Charge any additional filing fees required under 37 CFR 1.16 and 1.17.

Respectfully submitted,

Date:

*Sept 9, 1999*

By:

*William N. Hogg*

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CERTIFICATE OF MAILING BY "EXPRESS MAIL" (37 CFR 1.10)			DOCKET
Applicant(s): Parkes			JHP-10-5377
Serial No.	Filing Date	Examiner	Group Art Unit
To be assigned	Herewith		
Invention: <b>METHOD AND APPARATUS FOR ROCKET MOTOR DISPOSAL</b>			
<p>I hereby certify that the following documents</p> <p>New Utility Patent Application Transmittal</p> <p>Patent Application comprising <u>7</u> pages of specification, <u>3</u> pages of claims,  <u>1</u> page of Abstract and <u>3</u> sheets of drawings</p> <p>Declaration and Power of Attorney for Patent Application (unexecuted)</p> <p>Statement Claiming Small Entity Status (unexecuted)</p> <p>Certified copies of British Applications GB 9914598.9 and GB 9820720.2</p> <p>Acknowledgement post card</p> <p>are being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 in an envelope addressed to:</p> <p>Box Patent Application  Assistant Commissioner for Patents  Washington, D.C. 20231</p> <p>on September 9, 1999.</p> <p><u>CAROLE GIACOMAZZO</u>  (Typed or Printed Name of Person Mailing Correspondence)</p> <p><u>Carole Giacomazzo</u>  (Signature of Person Mailing Correspondence)</p> <p><u>EL 428565017US</u>  ("Express Mail" Mailing Label Number)</p>			

**STATEMENT CLAIMING SMALL ENTITY STATUS  
(37 CFR 1.9(f) & 1.27(b)) -- INDEPENDENT INVENTOR**Docket Number (Optional)  
**JHP-10-5377**Applicant, Patentee, or Identifier: JOHN HUMPHRIES PARKES

Application or Patent No.: \_\_\_\_\_

Filed or Issued: \_\_\_\_\_

Title: METHOD AND APPARATUS FOR ROCKET MOTOR DISPOSAL

As a below named inventor, I hereby state that I qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees to the Patent and Trademark Office described in:

- ☒ the specification filed herewith with title as listed above.  
                   the application identified above.  
                   the patent identified above.

I have not assigned, granted, conveyed or licensed and am under no obligation under contract or law to assign, grant, convey, or license, any rights in the invention to any person who would not qualify as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a non-profit organization under 37 CFR 1.9(e).

Each person concern, or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

- ☒ No such persons, concerns, or organizations exist.  
                   Persons, concerns, or organizations are listed below:

Separate verified statements are required from each named person, concern, or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

JOHN HUMPHRIES PARKES

NAME OF INVENTOR

\_\_\_\_\_  
Signature of Inventor\_\_\_\_\_  
Date

**APPLICATION**  
**FOR**  
**UNITED STATES LETTERS PATENT**

**APPLICANT'S NAME:**

**John Humphries Parkes**

**TITLE:**

**METHOD AND APPARATUS FOR ROCKET MOTOR DISPOSAL**

**DOCKET NO.:**

**JHP-10-5377**

# **METHOD AND APPARATUS FOR ROCKET MOTOR DISPOSAL**

## **Field of the Invention**

The present invention relates to a method and apparatus for rocket motor disposal.

## **Background of the Invention**

Large numbers of redundant munitions comprising rocket motors exist and environmentally friendly methods for their disposal are sought.

British Patent Application No. 2306884 describes a method of limiting the environmental disturbance of an exploding munition, such as a bomb, by spraying a liquid towards the munition to create a liquid dispersion which at least partly surrounds the munition and detonating the munition into the dispersion. That method is suitable for disposing of bombs, but may be unsuitable for disposing of certain rocket motors, despite the fact that these can be detonated or deflagrated without becoming propulsive.

## **Summary of the Invention**

It is an aim of the present invention to provide a safe, environmentally friendly and adaptable open burning method and apparatus for disposing of rocket motors.

According to one aspect of the invention, there is provided a method for disposing of a rocket motor comprising burning propellant contained within the



motor, and generating an enclosure of liquid within which the burning occurs. The enclosure or shroud of liquid captures particulate matter from the rocket motor's emissions.

In an embodiment of the invention, the liquid, which may comprise water, includes at least one neutralising chemical for neutralising noxious substances resulting from the burning and/or for capturing hazardous materials, such as asbestos.

Preferably, prior to the burning step, demilitarization or reverse engineering operations are carried out on a rocket-propelled munition of which the rocket motor forms a part. Such operations may comprise removal of a warhead, removal of an ancillary propulsion system and removal of a venturi mechanism. The best results are achieved when the motor is secured in a substantially vertical position, with its rear or exhaust end facing upwards, during the burning step. The method may comprise further steps of filtering liquid from said enclosure and recycling the filtered liquid to the enclosure.

According to another aspect of the invention, there is provided apparatus for disposing of a rocket motor, comprising means for generating an enclosure of liquid within which propellant contained within the motor can be burnt. Preferably, the liquid enclosure generating means comprises a nozzle having an outlet in the form of a closed figure, such as a circle. The apparatus preferably comprises means for securing the rocket motor in place. In a particular embodiment, the securing means and the liquid enclosure generating means are integral parts of the same unit. The apparatus preferably includes a pump for conveying liquid to the enclosure generating means. Filtering means for filtering liquid from the enclosure may also be included, as may a submersible pump for returning the liquid to a reservoir from which it may once again be conveyed to the enclosure generating means. Deflecting means, such as a hood and a conduit of large diameter, may optionally be provided for directing the exhaust plume and aerosolised liquid to a non-damaging location.

### **Brief Description of the Drawings**

The present invention will now be described in more detail, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is an elevation of a nozzle/securing unit according to an embodiment of the invention;

Figure 2 is a plan of the unit shown in Figure 1;

Figure 3 is a vertical section of the unit shown in Figures 1 and 2, taken along the line III-III in Figure 2;

Figure 4 shows a detail of the second shown in Figure 3;

Figure 5 schematically shows the unit of Figures 1 to 4 in use; and

Figure 6 is a schematic plan of apparatus according to an embodiment of the invention including the unit of Figures 1 to 5.

### **Detailed Description of the Invention**

Figures 1 to 4 show a unit 1 for securing a rocket motor and generating a liquid enclosure around burning propellant from the motor. The unit 1 comprises a frame 2 mounted on an open rectangular base 3. Adjustable clamps 4 provided on the frame 2 can be tightened to secure a rocket motor in place in the unit 1 with the rear or exhaust end of the motor facing upwards.

A pipe 5 mounted in a square around the bottom of the frame 2 has an inlet 6 to which a high-pressure pipeline can be fitted in a liquid-tight manner. A number (eight in this example) of vertical pipes 7 lead from the annular pipe 5 to an annular nozzle 8 mounted around the top of the frame 2. A detailed cross-section of the nozzle 8 is shown in Figure 4. The nozzle has a continuous annular outlet 9 having a radial width of typically 1.5 mm. Larger radial widths can be engineered if greater water flows are required.

Prior to the burning of its propellant, demilitarization or reverse engineering operations are carried out on a rocket-propelled munition to be disposed of. Firstly, the warhead (which may or may not be explosive) and any ancillary means of propulsion are removed. Having thusly separated the rocket motor from the missile, it is advisable, but not necessary, to remove the rocket motor's venturi mechanism. Such removal creates a less energetic exhaust flow and allows the formation of a denser and more easily contained exhaust cloud. If removal of the venturi mechanism is difficult or dangerous, then the apparatus of the invention can be designed to deal with rocket motors still having a venturi mechanism.

As shown in Figure 5, in use, the unit 1 is weighted down by placing heavy weights 10 on the base 3 of the unit. A high-pressure pipeline 11 is connected to the inlet 6. A rocket motor 12 is then placed in the frame 2 and the clamps 4 are tightened around the rocket motor. Water, optionally containing one or more neutralising chemical or mineral, is then forced through the pipeline 11, into the annular pipe 5, up the vertical pipes 7 and out of the outlet 9 of the annular nozzle 8. In this manner, a cylindrical enclosure 13 of water is formed, completely surrounding the exhaust plume 14 of the rocket motor 12. The water enclosure 13 captures noxious particulate matter exhausted from the burning propellant and thus keeps such matter on the already contaminated land of a purposely built munitions disposal facility and prevents exhaust emissions from entering the atmosphere.

Figure 6 is a schematic plan of such a facility. Water is supplied from a supply tank 15, in which pre-mixing of neutralising or decontaminating agents can take place if required, to a high pressure, high volume pump 16. The pump 16 can be driven by a fuel burning engine or by an electric motor, at least one large diesel engine being preferred for field operations.

The pump 16 forces water through the high pressure pipeline 11 to the unit 1. The area of ground on which the unit 1 is situated is provided with either a suitable pavement or a heavy duty membrane and has a slight gradient running downwards in the direction of the arrows. This means that contaminated water from the enclosure

flows into a catchment tank 17 where particles suspended in the water are allowed to settle. The catchment apron optionally includes a chalk or lime bed for neutralising acids from the rocket motor exhaust.

A submersible pump 18 is located in the catchment tank 17, spaced from the bottom of the tank so as to prevent sediment in the tank being drawn into the pump 18. The submersible pump is preferably hydraulically driven but may alternatively be electric. The pump 18 transfers the water to a filtration plant 19 and thence back to the supply tank 15 via a low pressure pipeline 20. Filtration beds could alternatively or additionally be included in the catchment tank 17. Preferably, there are two catchment tanks 17 which are used alternately so that the sediment layer can be periodically recovered, treated and disposed of.

While most of the water is recycled as described above, some topping-up of the supply tank 15 will be necessary as a result of evaporation.

The apparatus is portable and can be mounted on a trailer assembly for transportation and field use if the movement of rocket motors would present problems of logistics or safety.

Preliminary calculations which were used to design a nozzle and clamping unit according to the invention are given below:

Burn rate  $m = \frac{MF}{T}$   $m = 1.16$  kg/sec

Assume that the density of the cold exhaust gases would be  $\rho C = 1$  kg/m<sup>3</sup>

Assume that the exhaust temperature is 3500 K. The volume of gas per second is

$vol = m \cdot \frac{3500}{300} \cdot \rho C$   $vol = 13.55$  m<sup>3</sup>/sec

Guess rocket body diameter  $DR = 0.3$  metres

The velocity of the gas is  $velG = \frac{vol}{0.25 \cdot \pi \cdot DR^2}$   $velG = 191.64$  m/sec

Rocket thrust  $FT = m \cdot velG$   $FT = 222.52$  Newtons

Note that this would be much higher if the gases went through a Venturi.

The working pressure of the water pump is  $P = 8.5 \cdot 10^5$  Pascal

With efficient nozzles the water velocity  $velW = \sqrt{\frac{2 \cdot P}{998}}$   $velW = 41.27$  m/sec

Note that is this fast enough to induce cavitation round any sharp bend so we want a gentle convergence to the nozzle exit.

The area of the water jet nozzle will be  $Anozz = \frac{Q}{velW}$   $Anozz = 1.53 \cdot 10^{-3}$  m<sup>2</sup>

Nozzle gap is  $t = \frac{Anozz}{\pi \cdot kN \cdot DR}$   $t = 1.47 \cdot 10^{-3}$  metres

A sensible value would be  $t = 1.5$  mm

Guess heat of combustion  $H = m \cdot 25 \cdot 10^6$   $H = 2.9 \cdot 10^7$  Joules/sec

Latent heat of water  $LH = Q \cdot 1000 \cdot 2.25 \cdot 10^6$   $LH = 1.42 \cdot 10^8$  Joules/sec

The ratio of latent heat of boiling to heat in rocket exhaust is  $\frac{LH}{H} = 4.88$

## CONTROL PANEL

Rocket diameter	$DR = 0.3$	Burn time	$T = 180$
Nozzle to rocket diam.	$kN = 1.1$	Pump pressure	$P = 8.5 \cdot 10^5$
Fuel weight	$MF = 209$	Pump flow	$Q = 0.063$

Apparatus including a nozzle/clamping unit was constructed according to these criteria and tested against the live open burning of two rocket motors as a control. About 5 tons of water were pumped through the nozzle per minute. The apparatus achieved a dramatic reduction in exhaust emission. Noise was also greatly reduced and this is a further advantage of the invention. After the test, many tons of contaminated water were found to have been deposited downwind of the burning site.

In order to avoid the contaminated water from being carried downwind, a deflecting device in the form of a shroud or hood 21 is provided. (The support for the shroud or hood 21 is omitted). This will catch the contaminated water and direct it to a safe location.

## I CLAIM:

1. A method for disposing of a rocket motor having a propellant contained therein and having an exhaust, and comprising the steps of:  
burning said propellant and concomitantly generating an enclosure of liquid within which the burning occurs.
2. A method according to claim 1, wherein the liquid includes at least one neutralising chemical for neutralising at least some noxious substances resulting from the burning or for capturing hazardous materials, or both.
3. A method according to claim 1, wherein said rocket contains a venturi mechanism, and wherein said venturi mechanism is removed prior to the burning step.
4. A method according to claim 2, wherein said rocket contains a venturi mechanism, and wherein said venturi mechanism is removed prior to the burning step.
5. A method according to claim 1, wherein the motor is secured in a substantially vertical position, with its exhaust end facing generally upwards, during the burning step.
6. A method according to claim 2, wherein the motor is secured in a substantially vertical position, with its exhaust end facing generally upwards, during the burning step.

7. A method according to claim 3, wherein the motor is secured in a substantially vertical position, with its exhaust end facing generally upwards, during the burning step.

8. A method according to claim 1, comprising further steps of filtering liquid from said enclosure and recycling the filtered liquid.

9. A method according to claim 2, comprising further steps of filtering liquid from said enclosure and recycling the filtered liquid.

10. Apparatus for disposing of a rocket motor having a propellant therein, comprising:

a structure for supporting the rocket motor positioned for burning the propellant therein, and a liquid supply structure for generating an enclosure of liquid within which said propellant can be burnt.

11. Apparatus according to claim 10, wherein the liquid supply structure comprises a nozzle having an outlet in the form of a closed figure.

12. Apparatus according to claim 10, wherein the securing means and the liquid are integral parts of the same unit.

13. Apparatus according to claim 10 including a pump for conveying liquid to the liquid supply structure.

14. Apparatus according to claim 11, including a pump for conveying liquid to the liquid supply structure.



15. Apparatus according to claim 10, including filtering means for filtering liquid from said liquid supply structure.

16. Apparatus according to claim 11, including filtering means for filtering liquid from said liquid supply structure.

17. Apparatus according to claim 10, including a submersible pump for returning liquid from the liquid supply structure to a reservoir from which it may once again be conveyed to the enclosure generating means.

18. Apparatus according to claim 11, including a submersible pump for returning liquid from the liquid supply structure to a reservoir from which it may once again be conveyed to the enclosure generating means

19. Apparatus according to claim 10, including a deflecting device for directing an exhaust plume and aerosolised liquid to a non-damaging location.

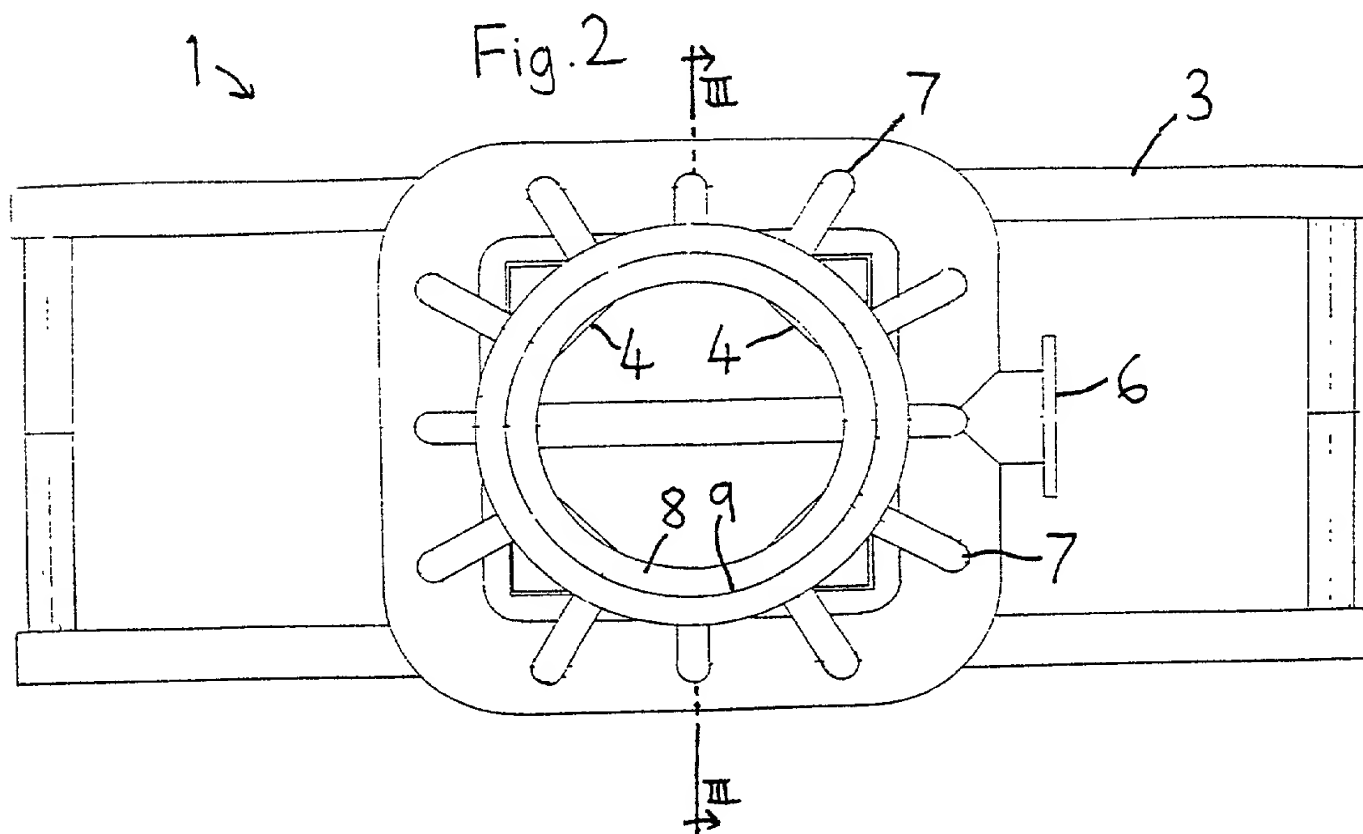
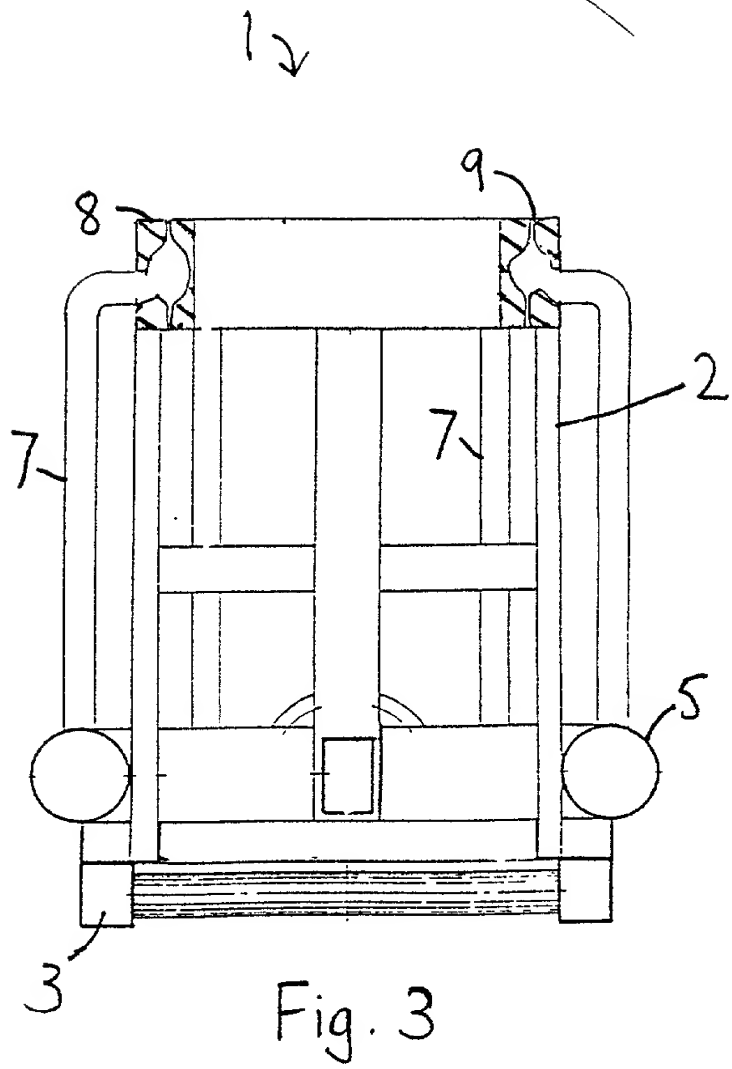
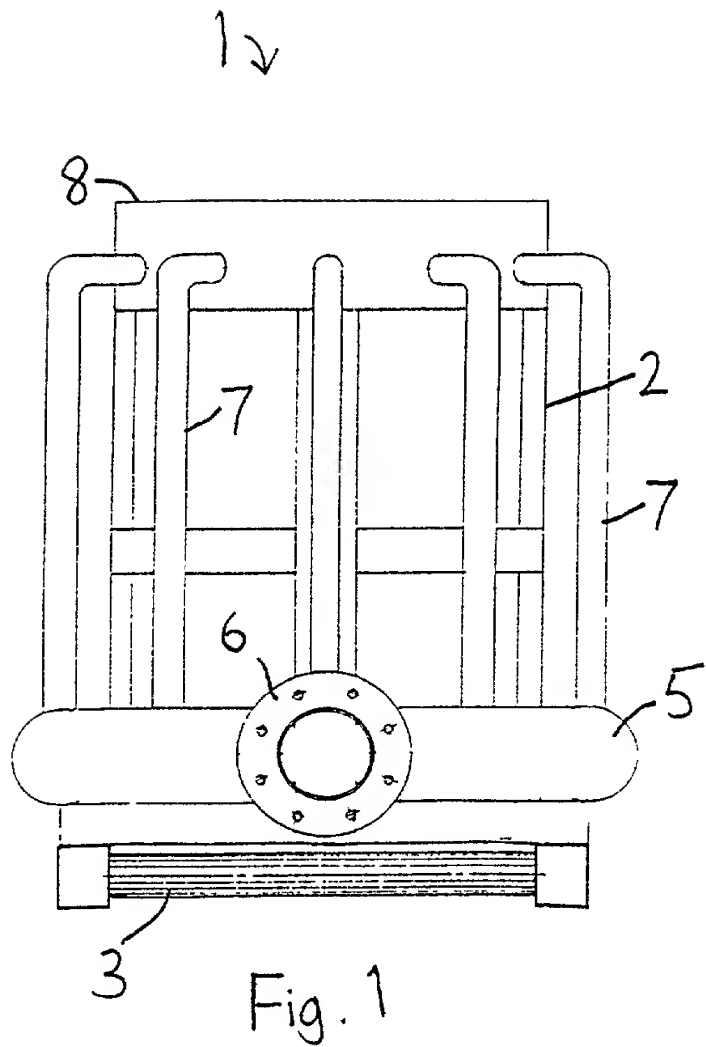
20. Apparatus according to claim 11, including a deflecting device for directing an exhaust plume and aerosolised liquid to a non-damaging location.

## METHOD AND APPARATUS FOR ROCKET MOTOR DISPOSAL

### Abstract

A method of disposing of a rocket motor 12 comprises burning propellant contained within the motor and generating an enclosure 13 of liquid within which the burning occurs. Apparatus for carrying out the method comprises a nozzle/clamping unit 1 for securing the rocket motor 12 in place and generating the liquid enclosure 13. The liquid, which may be water and may include neutralising chemicals, is filtered and recycled. (Figure 5)

1/3



2/3

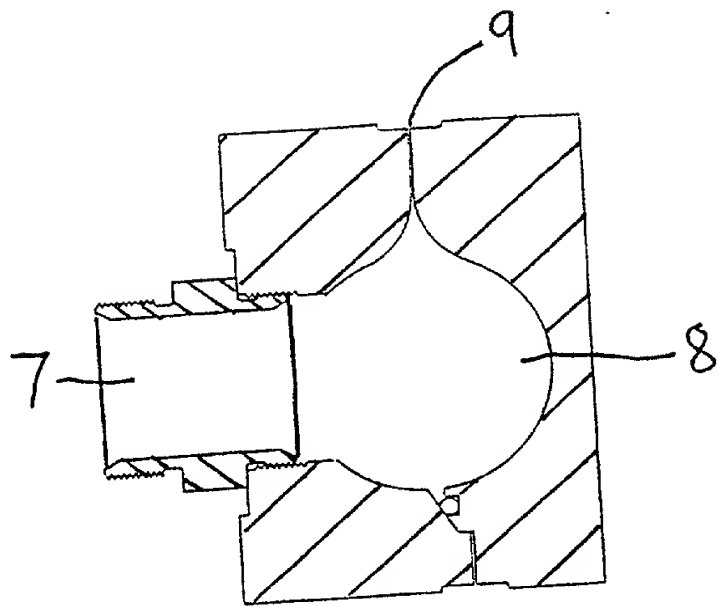
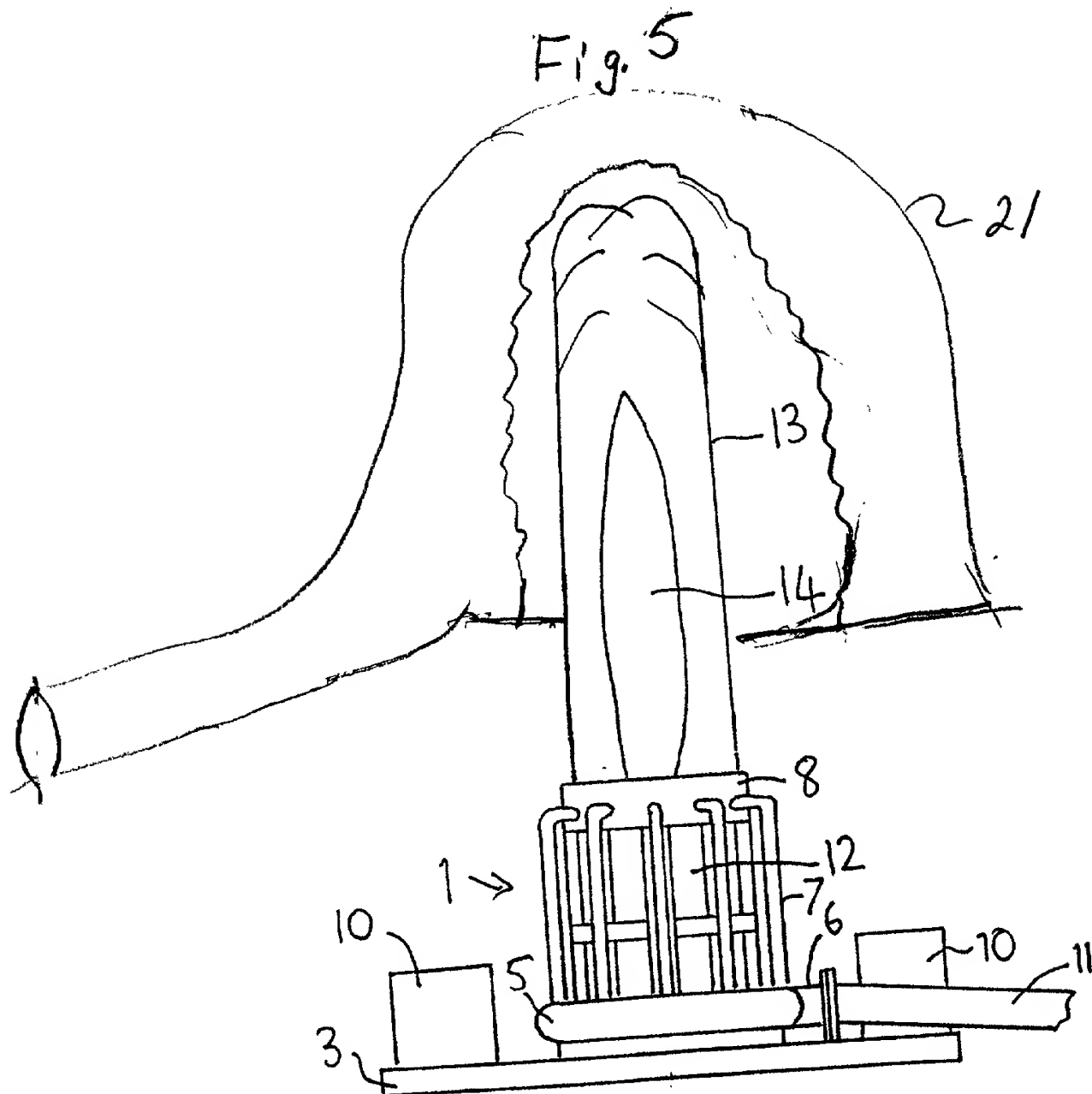


Fig. 4



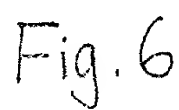


Fig. 6

DOCKET NUMBER: JHP-10-5377**DECLARATION AND POWER OF ATTORNEY FOR  
PATENT APPLICATION**

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name;

I believe I am the original, first and sole inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled

**METHOD AND APPARATUS FOR ROCKET MOTOR DISPOSAL**

the specification of which: (check one)

☒ is attached hereto.

☐ was filed on \_\_\_\_\_

under Attorney's Docket Number \_\_\_\_\_

as Application Serial No. \_\_\_\_\_

and was amended on \_\_\_\_\_ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with 37 CFR 1.56.

I hereby claim the benefit of foreign priority under 35 USC 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s):

Priority Claimed

GB 9914598.9  
(Number)

United Kingdom  
(Country)

June 22, 1999  
(Day/Month/Year)

X Yes    No

GB 9820720.2  
(Number)

United Kingdom  
(Country)

Sept. 24, 1998  
(Day/Month/Year)

X Yes    No

I hereby claim the benefit of United States priority under 35 USC 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the

(Status)